Sept. 25, 1956 S. L. RICHARDS, JR 2,764,218

APPARATUS FOR COATING AND REINFORCING PIPE

Filed Dec. 15, 1950

7 Sheets-Sheet 1

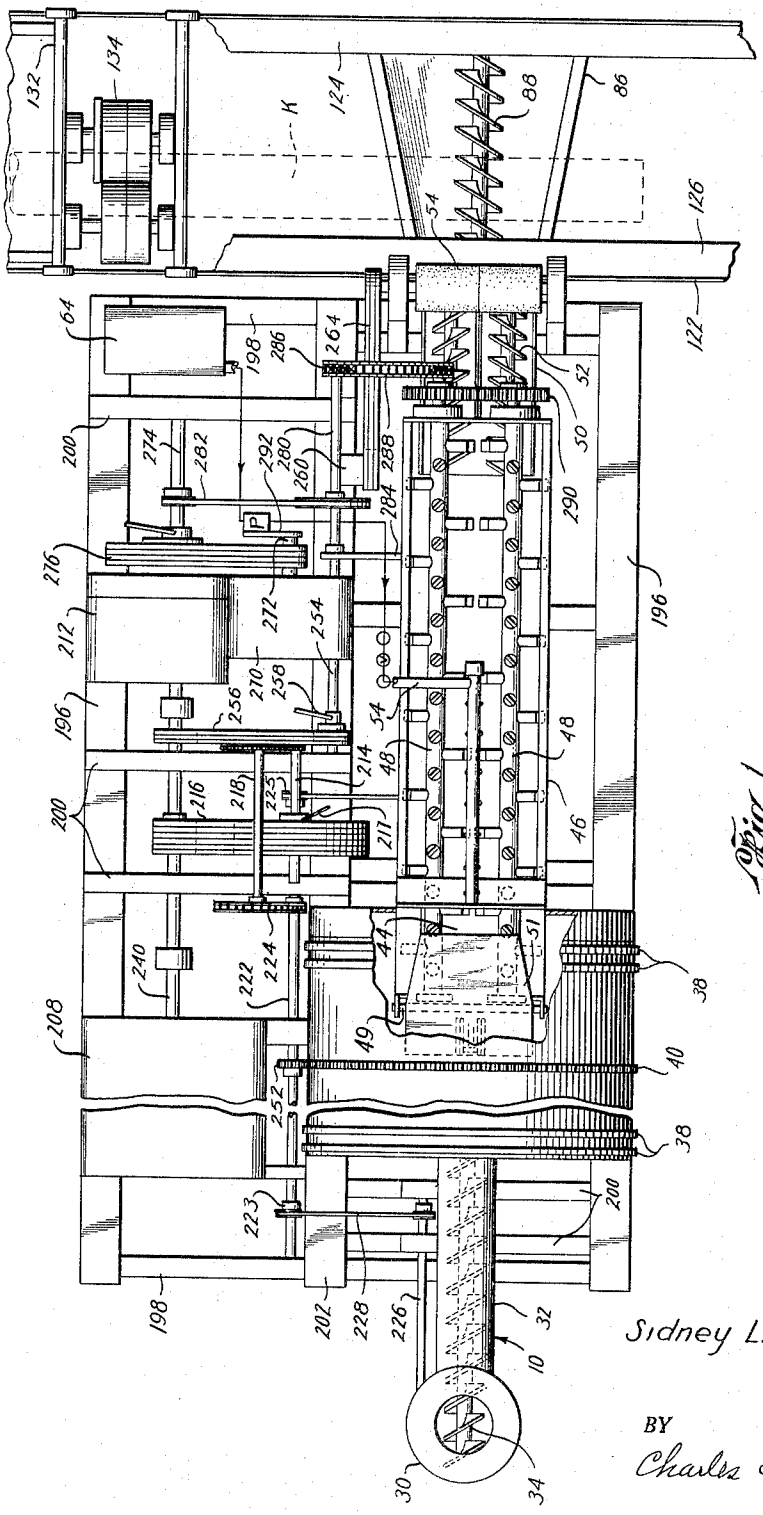


Fig. 1

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Sept. 25, 1956 S. L. RICHARDS, JR 2,764,218

APPARATUS FOR COATING AND REINFORCING PIPE

Filed Dec. 15, 1950 7 Sheets-Sheet 2

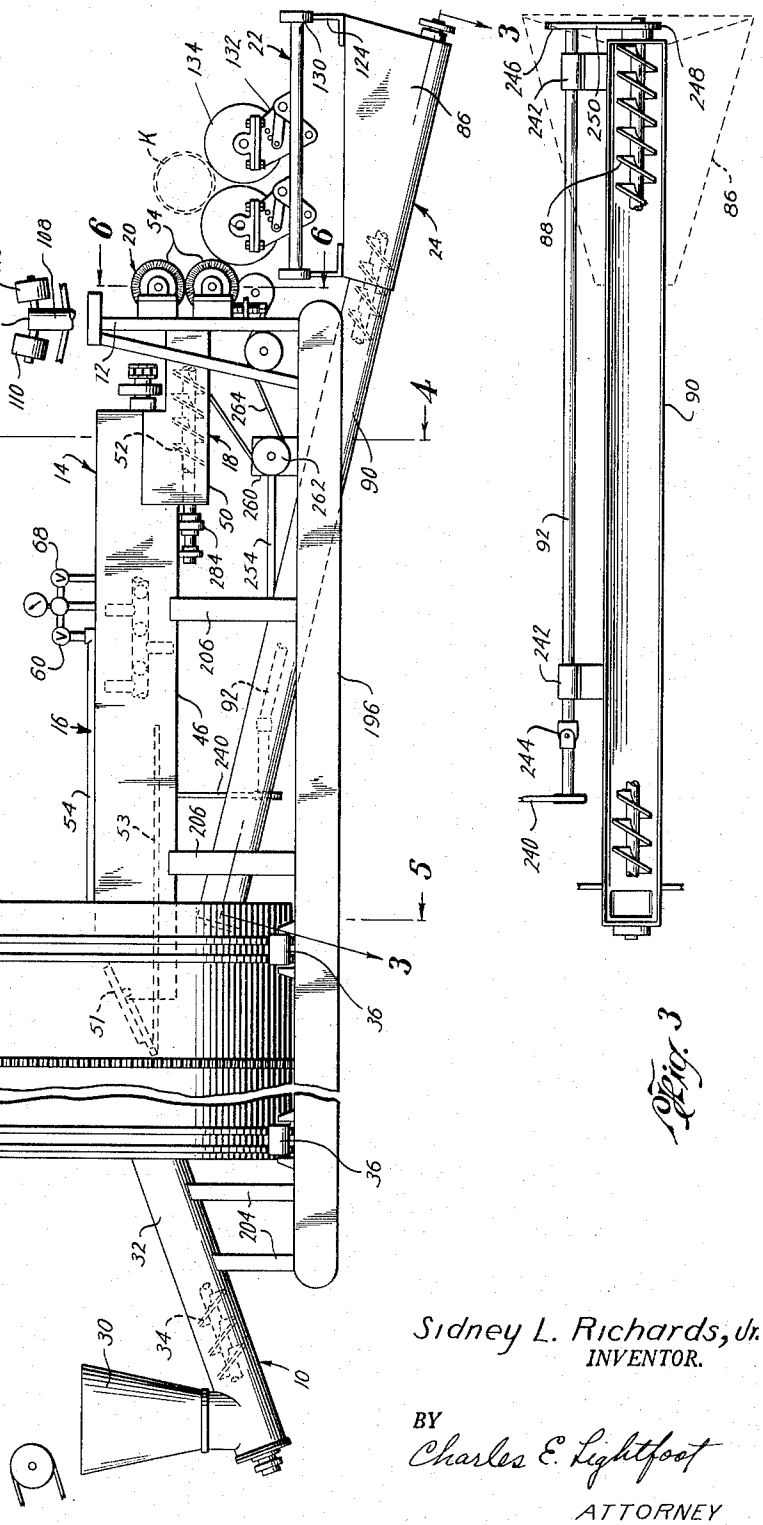


Fig. 2

Fig. 3

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APPARATUS FOR COATING AND REINFORCING PIPE

Filed Dec. 15, 1950 7 Sheets-Sheet 3

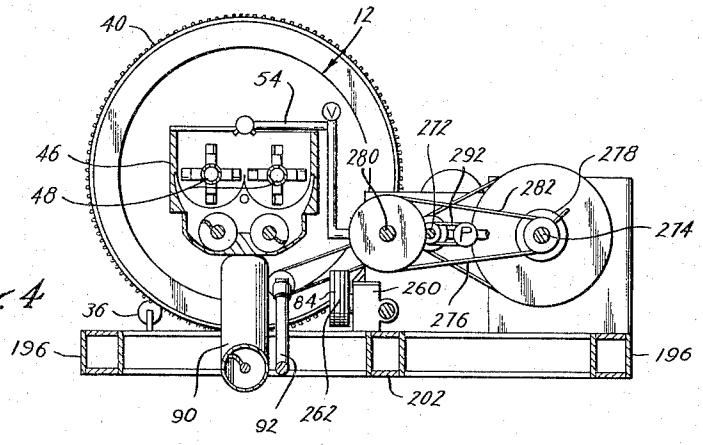


Fig. 4

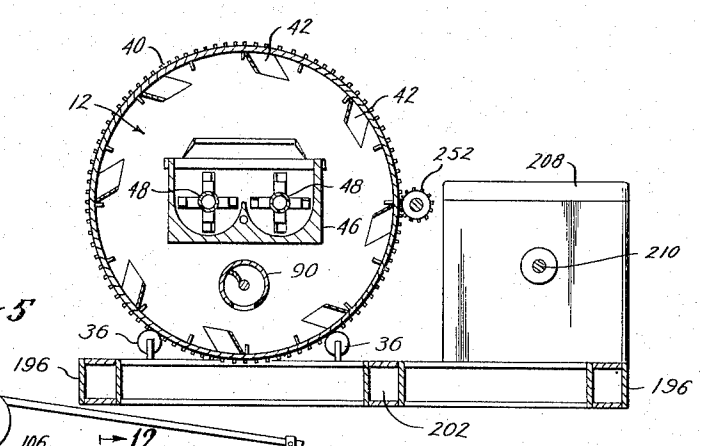


Fig. 5

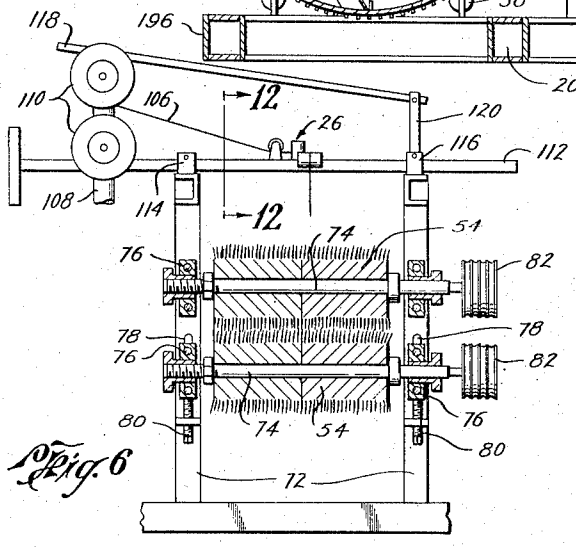


Fig. 6

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Sept. 25, 1956 S. L. RICHARDS, JR 2,764,218

APPARATUS FOR COATING AND REINFORCING PIPE

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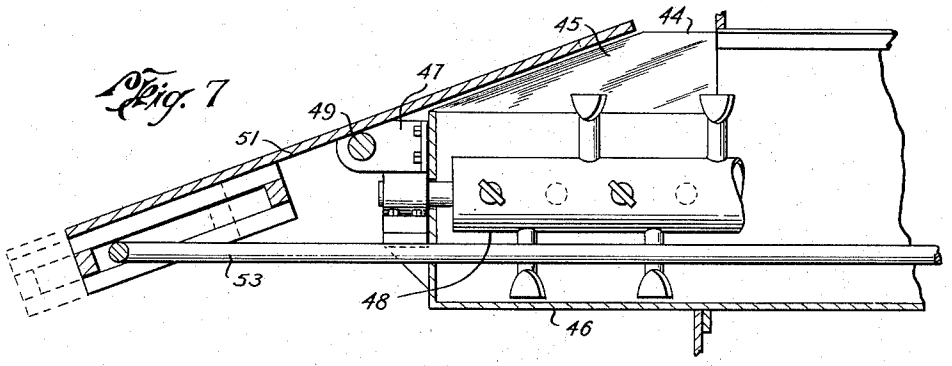


Fig. 7

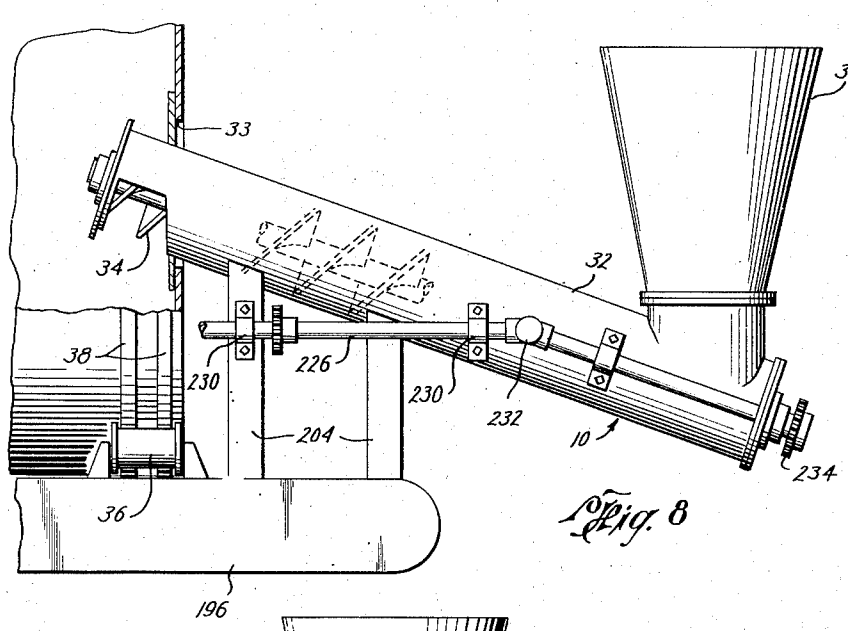


Fig. 8

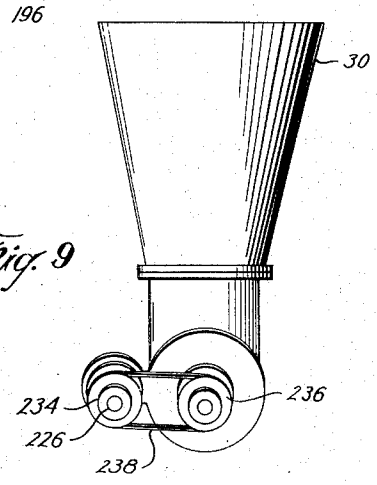


Fig. 9

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APPARATUS FOR COATING AND REINFORCING PIPE

Filed Dec. 15, 1950

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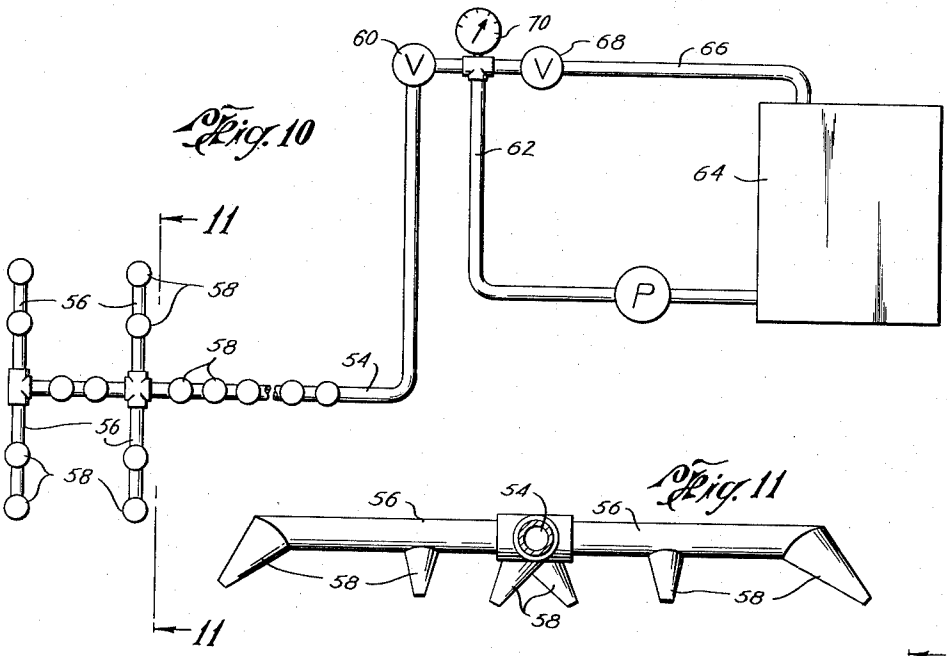


Fig. 10

Fig. 11

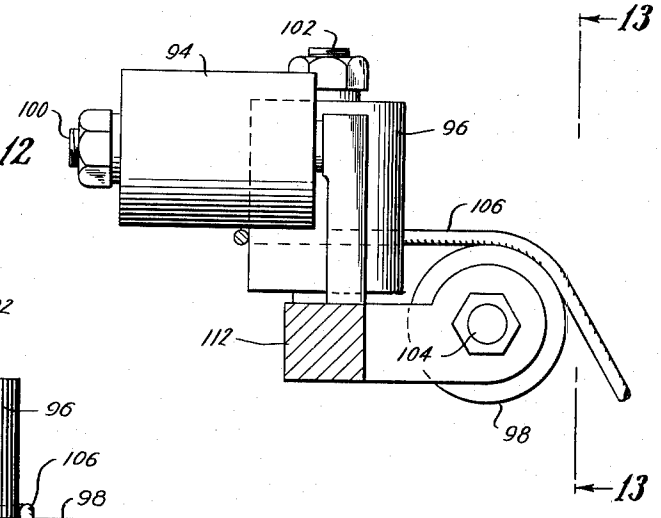


Fig. 12

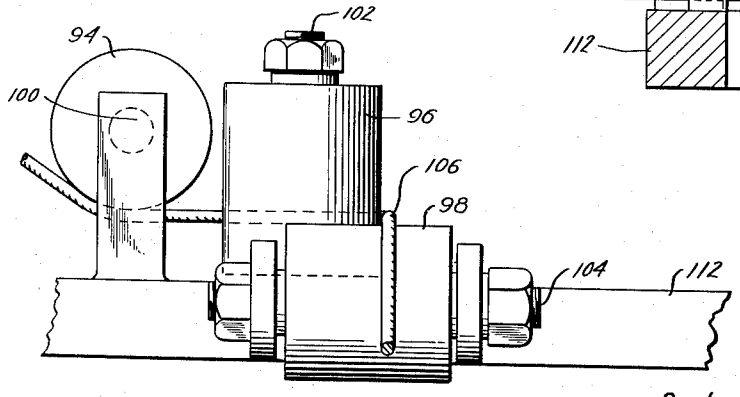


Fig. 13

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APPARATUS FOR COATING AND REINFORCING PIPE

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Fig. 14

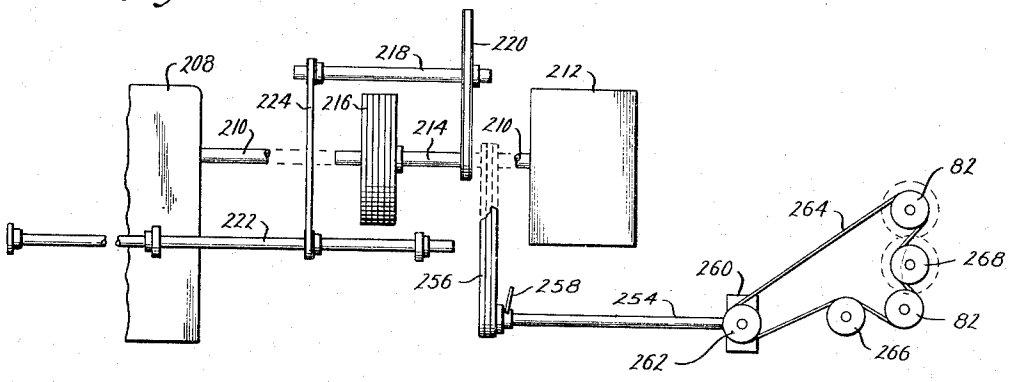


Fig. 20

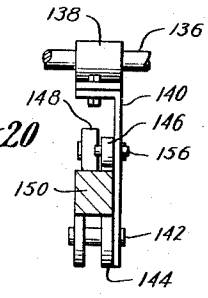


Fig. 15

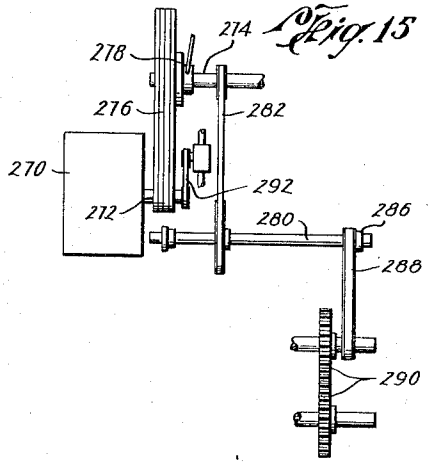
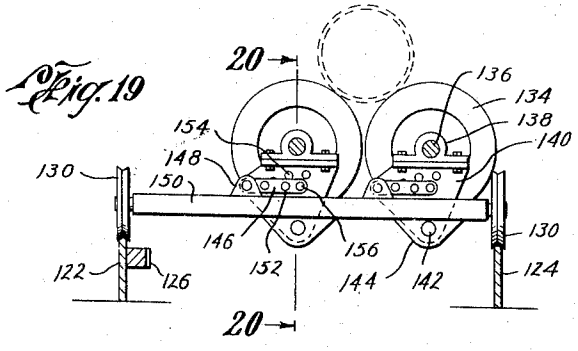


Fig. 19



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APPARATUS FOR COATING AND REINFORCING PIPE

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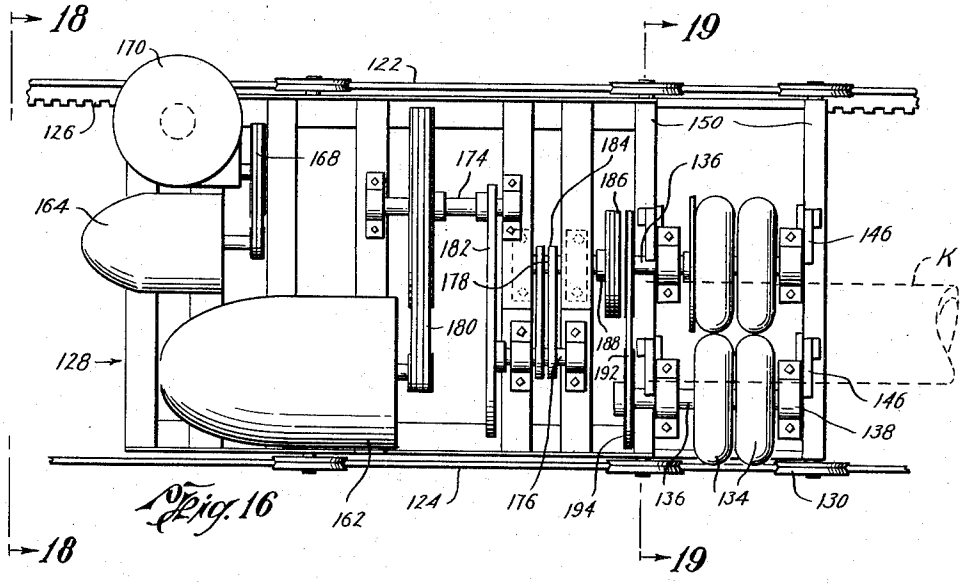


Fig. 16

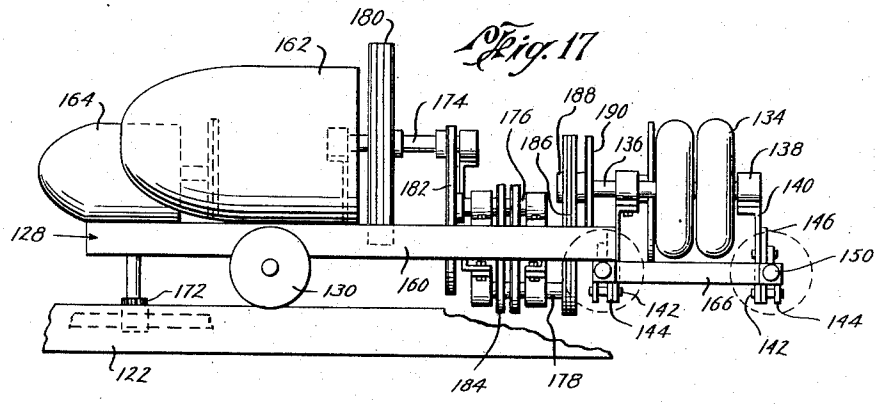


Fig. 17

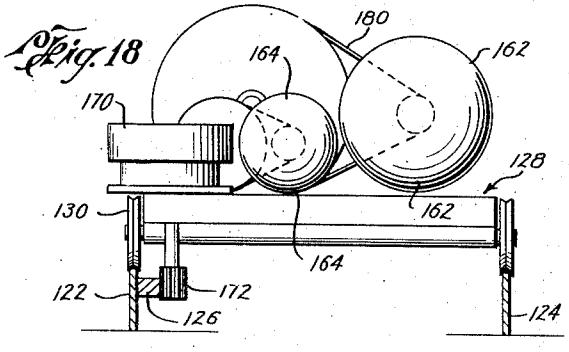


Fig. 18

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United States Patent Office 2,764,218 Patented Sept. 25, 1956

2,764,218

APPARATUS FOR COATING AND REINFORCING PIPE

Sidney L. Richards, Jr., Houston, Tex.

Application December 15, 1950, Serial No. 200,948

2 Claims. (Cl. 154—1.8)

This invention relates to a method and means for coating and reenforcing pipe, and more particularly to a method and apparatus for applying reenforced concrete to the outsides of pipes.

The invention finds particular application in the preparation of pipe which is to be used in the construction of pipe lines wherein portions of the pipe line must be suitably weighted to prevent upward movement of the same due to the buoying effect of water, in locations where the pipe is submerged or lies in soil whose water content is sufficient to have a floating tendency on the pipe.

An important object of the invention is to provide apparatus for supporting a pipe in position to be coated, and moving the pipe longitudinally while rotating the same, whereby a layer of weighting material of substantially uniform thickness may be applied throughout substantially the entire length of the pipe.

Another object of the invention is the provision of apparatus of the kind referred to having means for mixing the ingredients of the weighting material in a dry condition, adding water to the mix, and bringing the mixture to the desired consistency for application to the pipe.

A further object of the invention is to provide means for winding a continuous wire about the pipe as the same is moved longitudinally, and for positioning the wire at any desired depth in the coating material.

A further object of the invention is the provision of means for returning waste material to the mixing mechanism for remixing with additional coating material to be fed to the zone of application.

A further object of the invention is to provide a machine for coating a pipe having means for adding water to the mixed dry coating ingredients in controlled quantity, as the mixture is fed to the zone of application, whereby the consistency of the material may be regulated within narrow limits, thus assuring uniformity in the result obtained.

A further object of the invention is the provision of adjustable pipe supporting means whereby the position of a section of pipe may be adjusted with relation to the coating apparatus.

The above and other important objects and advantages of the invention will become apparent from the following detailed description, constituting a specification of the same when taken in conjunction with the annexed drawings wherein—

Figure 1 is a top plan view of the invention partly broken away and partly in cross-section;

Figure 2 is a side elevational view of the same;

Figure 3 is a cross-sectional view taken along the line 3—3 of Figure 2 looking in the direction indicated by the arrows;

Figure 4 is a cross-sectional view taken along the line 4—4 of Figure 2, looking in the direction indicated by the arrows;

Figure 5 is a cross-sectional view taken along the line 5—5 of Figure 2 looking in the direction indicated by the arrows;

Figure 6 is a cross-sectional view taken along the line 6—6 of Figure 2 looking in the direction indicated by the arrows;

Figure 7 is a fragmentary view partly in section, showing a portion of the mixing and feeding mechanism;

Figure 8 is a fragmentary view partly in section showing the mechanism by which the dry ingredients are fed into the mixing mechanism;

Figure 9 is an end elevational view looking at the right end of the apparatus shown in Figure 8;

Figure 10 is a plan view showing the piping system and control mechanism separated from the remaining portions of the machine, by which the addition of water to the dry ingredients is controlled;

Figure 11 is a cross-sectional view on a somewhat enlarged scale taken along the line 11—11 of Figure 10;

Figure 12 is a detailed view on a somewhat enlarged scale, partly in section, showing the guide means for the wire wrapping mechanism of the machine;

Figure 13 is an end view of the wire guide means looking at the right hand end of Figure 12;

Figure 14 is a fragmentary side elevational view showing a portion of the driving mechanism of the machine;

Figure 15 is a fragmentary plan view showing another portion of the driving mechanism of the machine;

Figure 16 is a plan view of the carriage by which the pipe is simultaneously moved longitudinally and rotated, while being coated;

Figure 17 is a side elevational view of the carriage shown in Figure 16;

Figure 18 is a cross sectional view taken along line 18—18 of Figure 16;

Figure 19 is a cross sectional view taken along line 19—19 of Figure 16; and

Figure 20 is a cross sectional view taken along line 20—20 of Figure 19.

Referring now to the drawings in greater detail, wherein the like numerals of reference designate the same parts throughout the several views, the numeral 10 indicates generally the means by which the dry ingredients of the weighting composition are introduced into the receiving end of a rotating mixing drum 12, for thorough mixing, after which the material passes out of the drum through mixing and feeding conveyors generally indicated by 14, wherein water is added to the mix through the piping system indicated by 16. From the mixing and feeding conveyors the moistened mix passes to feeding screws 18 and is fed to the revolving brush mechanism 20 by which it is projected onto the pipe K which is rotated and moved bodily past the brush mechanism by pipe supporting and rotating mechanism 22. Waste material from the pipe is collected in the return mechanism 24 by which it is returned to the mixing drum 12 to be mixed with further dry ingredients. Wire feeding and guiding mechanism 26 best seen in Figures 6, 12 and 13, is provided for continuously winding wire on the pipe as the same is rotated and moved past the coating machine.

The means by which the dry ingredients are fed to the mixing drum are best shown in Figures 8 and 9, and may conveniently be in the form of a hopper 30 from which a conveyor tube 32 housing feeding screw 34 extends into an open end 33 of the mixing drum. The mixing drum 12 is supported on spaced rollers 36, suitably attached to the frame of the apparatus, and supportingly engaging exterior tracks 38 on the drum, and the drum has an external ring gear 40 therearound by which the drum is rotated by means later to be described. Within the drum are inwardly extending veins 42 arranged to mix the dry ingredients upon rotation of the drum and to feed the same into the mixing and feeding conveyors through a variable opening 44 therein inside the drum.

The mixing and feeding conveyors extend into the discharge drum and include a trough like casing **46** within which are located a number of feeding and mixing devices **48**, in the present illustration two of such devices being employed. At its outer end the casing **46** opens downwardly into a casing **50** in which the feeding screws **52** are located, whereby the moistened mixture is fed to a plurality of rotating brushes **54**, which propel the material onto the pipe K. At the top of the casing **46**, there is located a water pipe **55** from which branch pipes **56** extend above the feeding and mixing devices **48** and are provided with downwardly directed nozzles **58** through which water is distributed to the mixture. The water pipe **55** leads through a valve **60** to an outlet pipe **62** connected to a pipe pump P which communicates with water source **64**. A return pipe **66** controlled by a valve **68** is also connected with the water pipe **55**, whereby excess water from the pump may be returned to the water source. A gauge **70** of conventional design is connected to the pipe **62**, and by suitably controlling the flow of water from the pump to the water pipe **55** by adjusting the valves **60** and **68**, the amount of water added to the dry mixed ingredients may be accurately regulated.

The rotary brush assembly **20** is supported by uprights **72** and comprises parallel horizontal shafts **74**, supported in bearings **76** attached to the uprights, the lower set of bearings being movably held in slots **78**, and adjustable vertically therein by means of screws **80**. Thus the brushes **54** may be suitably adjusted with relation to each other to uniformly propel the coating material onto the pipe K. Pulleys **82** are attached to the projecting ends of the shafts **74**, over which pulleys a driving belt passes whereby the brushes are rotated.

The waste return assembly **24** comprises a hopper **86** positioned beneath the pipe K below the brushes **54**, into which waste material may fall, and a return screw **88** rotatably carried in the tube **90** feeds the waste material from the hopper back into the mixing drum. The return screw **88** is driven by a shaft **92** through intermeshing gears or the like, and the shaft is rotated by suitable means later to be disclosed.

The wire feeding mechanism **26** includes a guide roller assembly located above the brushes **54**. Such assembly comprises rollers **94**, **96** and **98** rotatably mounted in suitable bearings. The roller **94** is supported horizontally on a shaft **100** at right angles to the vertical shaft of the roller **96**; and the roller **98** is supported horizontally on a shaft **104** at right angles to both the rollers **94** and **96**. The wire **106** may thus pass beneath the roller **94**, above the roller **96**, and over the roller **98** and downwardly and about the pipe K. The entire roller assembly is carried on a shaft **112** which is slidably mounted in bearings **114** and **116** on the uprights **72** so that the rollers may be moved horizontally to any desired position above the brushes in order to adjust the point at which the wire will be wound about the pipe in a direction parallel to the axis of the pipe.

A rack **108** is suitably located above the brushes for the support of reels of wire from which the wire is fed about the guiding rollers to be wound about the pipe. In order to properly tension the wire as it is wound about the pipe, means such as the weight bar **118** is pivotally secured at one end to the upper end of an upright **120** which is rotatably carried on one of the uprights **72**. The weight bar rests upon one of the reels **110** and may be of such weight as to give the desired tension to the wire as it is unwound therefrom. The weight bar may be shifted to engage any desired reel of wire and several such bars may be provided as desired. By properly tensioning the wire **106**, and adjusting the point at which it is wound on the pipe, with relation to the zone of application of the coating material, the depth at which the wire will be located in the coating may be regulated to any desired degree. Thus, the wire may be wound very close to the surface of the coating, or it may be positioned closely adjacent the surface of the pipe, or at any intermediate point in the depth of the coating, for purposes of securing the maximum reinforcing effect in the coating, and assuring that the coating will remain attached to the pipe, even under conditions of extreme bending of the pipe.

The mechanism by which the pipe is supported and moved longitudinally past the coating apparatus, while rotating the pipe is partly seen in Figures 1 and 2, and is illustrated in detail in Figures 16 to 20, inclusive, of the drawing. This mechanism takes the form of a track way having spaced apart rails **122** and **124**, the rail **122** being provided with an inwardly extending rack **126** extending over substantially its entire length. An operating carriage, generally indicated at **128**, having grooved wheels **130**, is disposed on the trackway, and a free carriage **132**, having similar wheels is also positioned on the trackway, these carriages being arranged to support the pipe for longitudinal movement along the track and to rotate the pipe as the same is moved past the coating apparatus. Both of the pipe supporting carriages are provided with sets of adjustable pipe engaging and supporting wheels or rollers **134**, which are preferably provided with rubber tires, and are adjustable laterally and vertically of the carriages, whereby the axis of a section of pipe of any diameter may be adjusted to bring the surface of the pipe into proper relation with the coating apparatus in order to secure the maximum efficiency in the coating operation. Thus, the pipe may be disposed on the carriages so that the coating material will strike the surface of the pipe at substantially a right angle, whereby a maximum of adherence of the coating material is secured, and loss of coating material is reduced to a minimum.

The sets of pipe engaging rollers are supported on the carriages in the manner illustrated in detail in Figures 19 and 20 of the drawing, wherein each pair of rollers is supported on a shaft **136** carried in suitable bearings **138**, attached to the upper ends of brackets **140**, which are pivotally attached at their lower ends to pivot pins **142** extending through lower brackets **144** attached to the frame structure of the carriage.

The pivoted brackets **140** are maintained in adjusted positions by means of links **146**, each of which is pivoted to a side bracket **148** on one of the axles **150**, and each link has a number of spaced holes **152** any of which may be brought into alignment with one of the holes **154** provided in the brackets **140**, so that a pin or bolt **156** may be placed through the aligned holes to connect the link to the pivoted bracket. It will be apparent that by removing the bolts **156** the pivoted brackets **140** may be moved to any desired position for adjusting the rollers **134** vertically and laterally of the carriage, to accommodate pipe sections of widely varying diameters, whereby the axis of the pipe may be located at the same position with relation to the coating apparatus. The bolts **156** may then be reinserted in the aligning holes in the links and pivoted brackets, to secure and maintain the rollers in adjusted position.

The operating carriage **128**, as best seen in Figures 16, 17 and 18 has a main frame **160**, upon which the driving motors **162** and **164** are mounted and is provided at one end with a sub-frame **166**, upon which the pipe engaging rollers are mounted. The motors **162** and **164** are preferably electric motors, the motor **164** having a belt drive **168** through which the transmission mechanism **170** is operated, and which in turn rotates the vertical pinion **172** engaging the rack **126** of the rail **122**, whereby the operating carriage is propelled along the tracks.

Motor **162** is connected in driving relation to the sets of rollers by means of a series of counter-shafts **174**, **176** and **178**, connected by suitable driving belts such as those indicated at **180**, **182** and **184**, respectively. The lowermost counter-shaft **178** is operatively connected by a driving belt **186**, to a pulley **188** attached to one of the shafts **136**, the arrangement being such that the rollers **134** may be adjusted laterally and vertically of

the frame of the operating carriage without interference with the driving mechanism of the rollers. Each of the shafts **136** also has a pulley **190** thereon, and these pulleys are operatively connected by a driving belt **192**, whereby both sets of the rollers **134** will be simultaneously operated to rotate a pipe section supported thereon.

Suitable electrical controls and wiring, not shown, are provided for the operation of the motors **162** and **164**, which controls may be located in any convenient position for the use of the operator of the machine. It will be apparent that by controlling the speed of the motors **162** and **164** a section of pipe supported on the operating carriage and the free carriage may be moved longitudinally of the track and rotated at the same time at any desired rate of speed, whereby the uniform coating of the pipe as the same passes in front of the coating mechanism may be accomplished.

The entire coating apparatus may be mounted on a base, as best seen in Figures 1 and 2 of the drawings, which base conveniently takes the form of a frame having longitudinal side members **196**, connected at the ends by end members **198**, and having cross ties **200**, located at suitable intervals immediate the ends of the frame. The frame may also have a substantially centrally located longitudinal member **202**, connected to the end members **198** and to which the cross ties **200** are secured. Upright supports **204** attached to the base, support the mechanism **10**, by which the dry ingredients are introduced into the mixing drum, and additional upright supports **206** secured to the base immediate its ends, support the mixing and feeding apparatus **14** thereon.

The driving mechanism by which the entire coating machine mechanism is operated will best be seen in Figures 1, 2, 14 and 15 of the drawings. This driving mechanism comprises an engine **208**, of the internal combustion type, which drives a shaft **210**, connected in driving relation to an electrical generator **212** and also driving a shaft **214**, through a suitable belt connection **216** and a clutch **217**. Shaft **214** is in driving connection with a counter-shaft **218**, through suitable sprockets and a driving chain **220**, and the counter-shaft **218** is in turn drivingly connected to a shaft **222**, through suitable sprockets and a drive chain **224**, whereby the need of rotation of the shaft **222** with relation to the shaft **214** may be predetermined as desired. Shaft **222** is provided with suitable sprockets or pulleys, one of which indicated at **223** is drivingly connected with a similar sprocket or pulley on a counter-shaft **226** by means of a belt or chain **228**, which counter-shaft **226** is carried in suitable bearings **230** attached to one of the uprights **204** and to the conveyor tube **32**. A universal joint **232** is provided in the shaft **226**, and at its outer end this shaft has a sprocket **234**, which is drivingly connected to a similar sprocket **236** by means of chain **238**, the sprocket **236** being attached to the outer end of the shaft of the conveyor screw **34**, whereby the conveyor screw is rotated to feed dry material to the mixing drum. The other pulley or sprocket **225** of the shaft **222** is drivingly connected with the drive shaft **92**, by means of a suitable belt or chain **240**, and the shaft **92** is carried in suitable bearings **242** attached to the return tube **90**. Shaft **92** has a universal joint **244**, and carries at its lower end suitable means, such as a sprocket **246**, which is drivingly connected to a similar sprocket **248** by a chain **250**, the sprocket being attached to the outer end of the shaft of the return screw **88**, whereby this screw may be operated to return waste material from the hopper **86** to the mixing drum. Shaft **222** also carries a gear **252**, which meshes with the external ring gear **40** by which the mixing drum is rotated.

Shaft **210**, which is driven by the engine is also drivingly connected to a shaft **254**, through the intermediation of suitable sprockets, or pulleys and a drive chain **256** or driving belt, and suitable clutch means **258**, whereby the operation of the shaft **254** may be controlled. Shaft **254** is connected to a right angle transmission gear mechanism **260**, which rotates a pulley **262** which is in turn drivingly connected to the brushes **54** by means of a driving belt **264**, which passes over the brush pulleys **82**. Idler pulleys **266** and **268** may be provided for assuring adequate driving contact between the belt **264** and the brush pulleys **82**, as best seen in Figure 14 of the drawing.

An electric motor **270** is connected to be driven by the generator through any suitable electrical circuit not shown. This motor has a shaft **272** which is drivingly connected to a counter-shaft **274**, by means of suitable sprockets, pulleys or the like and a sprocket chain or driving belt **276**. Suitable clutch means such as **278** may be interposed in the driving connection between the shaft **272** and the shaft **274**, to control the operation of the latter. The counter-shaft **274** is drivingly connected to a shaft **280**, through the intermediation of sprockets or pulleys, and a drive chain or belt **282**, and this shaft **280** is drivingly connected to the feeding screws **52** by suitable pulleys or sprockets over which a chain or belt **284** operates. The shaft **280** is also provided with another sprockets **286**, which is operatively connected by means of a chain **288** with a sprocket on the end of the shaft hub. The shafts of the mixing devices **48** are provided with intermeshing gears **290**, whereby these devices will be simultaneously rotated by operation of the shaft **280**, upon operation of the electric motor **270**.

The shaft **272** of the electric motor is also operatively connected with the pump P by suitable sprockets or pulleys mechanism indicated at **292**. The driving mechanism which is operated by the electric motor **270** is best seen in Figure 15 of the drawing.

The end of the mixing mechanism which projects into the mixing drum has a variable opening **44** therein, as previously described, and is provided with sloping sides **45**. Spaced brackets **47** extend from the end of the mixing mechanism, between which brackets a shaft **49** is supported, and a slidable cover plate **51** is supported on the shaft **49**, which plate is operatively attached to a rod **53**, leading to some convenient point for operation to adjust the position of the cover **51** to increase or decrease the size of the opening **44**, as will best be seen in Figure 7 of the drawing. By adjusting the size of the opening **44**, the amount of the dry mix ingredients admitted from the drum to the mixing mechanism can be accurately regulated.

It is believed that the operation of the coating machine will be apparent from the above description. In the operation of the machine the dry ingredients are dumped into the hopper **30**, from whence they will be conveyed by way of the conveyor **32** by the feeding screw **34** into the mixing drum **12**, wherein they will be thoroughly intermingled by rotation of drum and fed through the opening **44** into the mixing mechanism **14**. In the mixing mechanism the ingredients will be further mixed by the mixing screws **48**, while moisture is added to the ingredients through the pipe **55**, branch pipes **56**, and nozzles **58**, whereby the ingredients will be moistened to the exact degree desired and moved through the mixing mechanism into the casing **50**. The moistened material is then fed by the screws **52** to the brushes **54**, which propel the same against the pipe K, which is being simultaneously moved past the brushes and rotated. At the same time the wire **106**, which has been secured above the pipe K is wound about the pipe, forming a spiral reinforcement in the coating at the desired depth therein. Any material which does not adhere to the pipe K immediately falls into the waste hopper **86** from whence it is returned to the mixing drum by the screw **88** operating in the return tube **90**.

It will thus be seen that by suitably controlling the speed of rotation and longitudinal movement of the pipe K, as well as the amount of material which is projected by the brushes **54** against the outer surface of the pipe, a coating of uniform character and any desired thickness may be obtained on the pipe. It will also be apparent

that the entire mechanism may be easily operated by a single operator through the various controls provided, so that the operation of the machine can be closely regulated to secure uniform results.

The invention has been disclosed in connection with a specific embodiment of the same, but it will be understood that this is intended by way of illustration only, and numerous modifications may be made in the construction and arrangement of the various parts, without departing from the spirit of the invention, and within the scope of the appended claims.

What is claimed as new and desired to secure by Letters Patent is—

1. An apparatus for coating pipe comprising supporting means rotatively carrying a pipe to be coated, said supporting means being movable in the direction of the axis of the pipe, coating applying means disposed to propel a plastic coating composition against the pipe throughout a zone of limited extent in a direction longitudinally of the pipe, means for supporting a wire to be wound about the pipe in said zone, means for effecting rotation of the pipe and longitudinal movement of the supporting means to effect winding of the wire in a spiral about the pipe, and means adjustable longitudinally of said zone for guiding the wire to adjust the location at which the wire is wound on the pipe in said zone to regulate the depth to which the wire is embedded in said coating.

2. An apparatus for coating pipe comprising supporting means rotatively carrying a pipe to be coated, said supporting means being movable in the direction of the axis of the pipe, coating applying means disposed to propel a plastic coating composition against the pipe throughout a zone of limited extent in a direction longitudinally of the pipe, means for supporting a wire to be wound about the pipe in said zone, means for effecting rotation of the pipe and longitudinal movement of the supporting means to effect winding of the wire in a spiral about the pipe, means adjustable longitudinally of said zone for guiding the wire to a selected location in said zone, and means for tensioning the wire to regulate the depth to which the wire is embedded in said coating.

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